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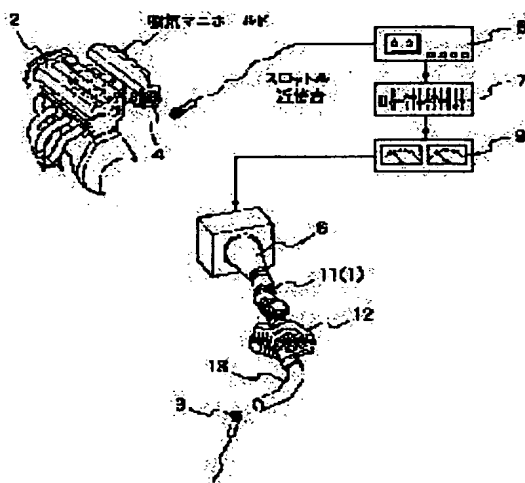
(72)Inventor : TANGE KATSUHIRO
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(54) METHOD FOR EVALUATING VEHICLE INTAKE SOUND

(57)Abstract:

PROBLEM TO BE SOLVED: To achieve a method for evaluating a vehicle intake sound that can suppress costs for measuring facilities and at the same time can drastically improve an evaluation accuracy.

SOLUTION: Adjustment is made so that sound near the throttle of an engine 2 nearly matches sound near a connection part for mounting intake system parts being located at the exit of a speaker, when the sound near the throttle is inputted to the speaker for vibrating it. The measured data of the intake sound being measured by vibrating the speaker where the sound near the above throttle is inputted are subtracted from the measured data of the intake sound of an actual machine, when an engine is actually working after the intake system parts are assembled to the engine 2 for calculating a correction value, and then the above speaker is vibrated and the correction value is added to the intake sound measured value of the suction system parts being measured for evaluation.



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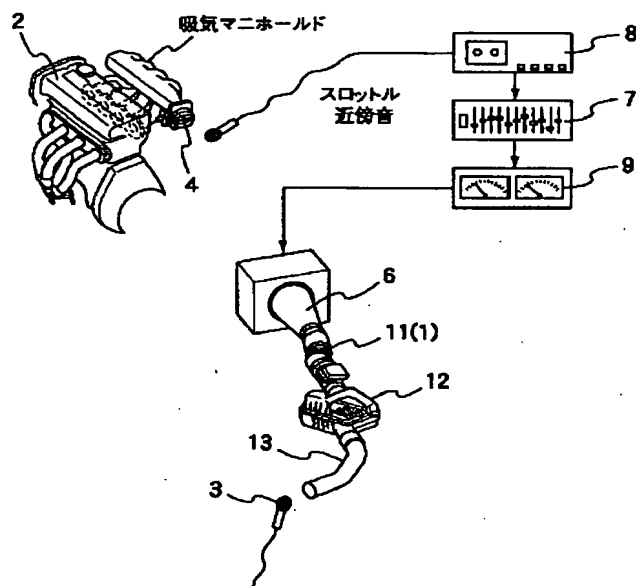
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(54) 【発明の名称】 車両吸気音の評価方法

(57) 【要約】

【課題】 測定設備にかかる費用を低く抑えながら、評価精度を大幅に向上させることのできる車両吸気音の評価方法を提供する。

【解決手段】 エンジン2のスロットル近傍音と、該スロットル近傍音をスピーカ5に入力してそのスピーカ5を加振させたときのスピーカ出口にある吸気系部品取付用の接続部近傍音と、を略一致させるように調整し、次いで、吸気系部品1をエンジン2に組み付けてのエンジン実働における実機吸気音の測定データから、前記接続部6に前記吸気系部品1を取付け、前記スロットル近傍音が入力されたスピーカ5を加振させ測定した吸気音の測定データを差引いて補正値を算出し、その後、前記スピーカ5を加振させて測定した吸気系部品1の吸気音測定値に、該補正値を加味して評価を行う。



【特許請求の範囲】

【請求項1】 エンジンのスロットル近傍音と、該スロットル近傍音をスピーカに入力してそのスピーカを加振させたときのスピーカ出口にある吸気系部品取付用の接続部近傍音と、を略一致させるように調整し、次いで、吸気系部品をエンジンに組み付けてのエンジン実働における実機吸気音の測定データから、前記接続部に前記吸気系部品を取付け、前記スロットル近傍音が入力されたスピーカを加振させ測定した吸気音の測定データを差引いて補正値を算出し、その後、前記スピーカを加振させて測定した吸気系部品の吸気音測定値に、該補正値を加味して評価を行うことを特徴とする車両吸気音の評価方法。

【発明の詳細な説明】**【0001】**

【発明の属する技術分野】 本発明は、乗用車等のエンジン回転時における吸気音を評価するのに用いる車両吸気音の評価方法に関する。

【0002】

【従来の技術】 近年、自動車の騒音低減要求が以前にも増して高まっており、その一つとして、エンジン回転時の吸気音についても低減要求が出てきている。そして、低騒音の吸気系部品の開発と共に、吸気音の評価方法についても注目されるようになってきた。ここで、吸気音とは一般にシリンダに空気が入り込む時に発生する音が吸気系部品を伝達して吸気ダクトの先端から発生する放射音を指す。現在、吸気音を評価する方法として、ファイヤリング法（実機吸気音測定法）とモータリング法が知られている。ファイヤリング法は、実際にエンジンに吸気系部品を組み付け、エンジンを実働させて実機吸気音を測定する方法である。実機吸気音の測定は、図1のようにエンジンに吸気ダクトアッセンブリを装着した時の吸気口右10cm、45°位置の音を測っている。モータリング法も実際にエンジンに吸気系部品を組み付けて測るのであるが、エンジンをモータで回転させてその吸気音を測定する方法を採っている。

【0003】

【発明が解決しようとする課題】 ところで、上記ファイヤリング法は、評価精度は良いが、測定設備が非常に大掛りなものとなり、測定に要する費用も高くつく難点があった。エンジンを実働させるための設備が必要だからである。一方、モータリング法はエンジンの改造が必要で工数がかかるものの、その測定設備は大掛りにはならず設備費用を抑えることができる。しかしながら、モータを回すだけでのものであり、その評価精度があまり良くなかった。

【0004】 本発明は、上記問題点を解決するもので、測定設備にかかる費用を低く抑えながら、評価精度を大幅に向上させることのできる車両吸気音の評価方法を提供することを目的とする。

【0005】

【課題を解決するための手段】 上記目的を達成すべく、請求項1記載の発明の要旨は、エンジンのスロットル近傍音と、該スロットル近傍音をスピーカに入力してそのスピーカを加振させたときのスピーカ出口にある吸気系部品取付用の接続部近傍音と、を略一致させるように調整し、次いで、吸気系部品をエンジンに組み付けてのエンジン実働における実機吸気音の測定データから、前記接続部に前記吸気系部品を取付け、前記スロットル近傍音が入力されたスピーカを加振させ測定した吸気音の測定データを差引いて補正値を算出し、その後、前記スピーカを加振させて測定した吸気系部品の吸気音測定値に、該補正値を加味して評価を行うことを特徴とする車両吸気音の評価方法にある。

【0006】 請求項1記載の発明のごとく、スピーカを加振させて測定した吸気系部品の吸気音に補正値を加味して評価を行うと、吸気部品を実機に組み付けたときのみ起るヘルムホルツ共鳴等の影響分も加味されるので、測定設備を簡易にしながらも精度のよい評価が可能になる。

【0007】

【発明の実施の形態】 以下、本発明に係る車両吸気音の評価方法の実施形態について詳述する。図1～図8は本発明の車両吸気音の評価方法に使用される装置等の一形態を表し、図1はある吸気系部品の実機吸気音を測定する装置の説明図、図2はイコライザーのゲイン調整の様子を示す説明図、図3はイコライザーのゲイン調整後のグラフ、図4はエンジンのスロットル近傍音を用いて、スピーカ加振法により吸気音測定している説明図、図5は図4のスピーカ加振法による吸気音と実機吸気音との測定対比グラフ、図6は補正値のグラフ、図7は別の吸気系部品を組み付けた場合のスピーカ加振法による吸気音と実機吸気音との測定対比グラフ、図8は図7のスピーカ加振法の吸気音に補正値を加味した吸気音補正データと実機吸気音との測定対比グラフである。尚、図5～図8のグラフで、実機とあるのは実機吸気音を意味し、加振とあるのはスピーカ加振法による吸気音を意味する。

【0008】 本発明の車両吸気音の評価方法は、例えば次のような手順によって行われる。まず、第一操作として、エアホース11、エアクリーナ12、吸気ダクト13等を備えた或る吸気系部品1を実際にエンジン2に組み付けて、エンジン回転時における実機吸気音を測定する（図1）。図5の実線グラフはこのエンジン回転時における実機吸気音の測定結果を表す。吸気音の測定は、図示のごとく吸気系部品1の吸気口右10cm、45°位置の音を測定する。符号3は吸気音測定器を示す。

【0009】 次に、図2のごとく、実機エンジン2のスロットル近傍音を測定する（第二操作）。そして、第三操作として、この実機エンジン2のスロットル近傍音

と、該スロットル4の近傍音をスピーカ5に入力してそのスピーカ5を加振させたときのスピーカ出口にある吸気系部品取付用の接続部近傍音と、を略一致させるように調整する。具体的には、イコライザー7のゲインを調整することによって、スロットル近傍音と接続部近傍音とを一致させる。図2中、符号8はデータレコーダ、符号9はアンプを示す。尚、接続部6には、測定しようとする吸気系部品1を取付け易くすべく、加振用スピーカ5からコーン状に絞った絞り部が形成される。図3は、こうしてスロットル近傍音（実機）に接続部近傍音（スピーカ加振）を一致させたグラフを示す。尚、本実施形態では4気筒エンジンを使用している。そのため、2、4、6、…回（エンジン1回転に変動する回数）でトルク変動が発生し、振動強制力により騒音を発する。これを回転の2次、4次、6次成分というが、図3の各グラフはこの回転2次、4次、6次の近傍音を表す。図5～図8の各グラフもこの回転2次、4次、6次に対応する。

【0010】続いて、前記吸気系部品1とスロットル近傍音を用いて、スピーカ加振法により吸気音を測定する（第四操作）。詳しくは、接続部6に前記吸気系部品1を取付けた後、実機エンジン2のスロットル近傍音を録音したデータレコーダ8を再生し、これにイコライザー7の前述したゲイン調整をかけてアンプ9で増幅してスピーカ5を加振させ、吸気系部品1の吸気口の吸気音を測定する（図4）。図5の破線グラフはこのスピーカ加振法により吸気音を測定した結果を表す。

【0011】その後、前記第一操作で得られたエンジン実働における実機吸気音の測定データから、上記接続部6に吸気系部品1を取付け、スロットル近傍音が入力されたスピーカ5を加振させ測定した吸気音の測定データを差引いて補正値を算出する（第五操作）。補正値は、図5で説明すると、実線で表した実機吸気音の値からスピーカ加振法による吸気音の値を差引いたものであり、該補正値のみグラフ化すれば、図6のようになる。該補正値を算出するのは、吸気系部品1とスロットル近傍音を用いて、スピーカ加振法により吸気音を測定する方法にとどめてしまうと、スピーカ加振法における吸気音測定値がエンジン実働の実機吸気音測定値との間でズレを生むからである。すなわち、エアホース11、エアクリーナ12、吸気ダクト13等の吸気系部品1を組み付けて測定すると、エンジン実働のケースだけが、エンジン2のシリンダを丁度ヘルムホルツの共鳴機構に成立させ、吸気音を減衰させる事態が発生するので、両測定値に違いをみせるのである。図9を使って、この吸気音の減衰についてももう少し詳しく説明すると次のようになる。或るシリンダaにおいて、吸気弁bが開き、ピストンが下降して空気を吸込むときに音が発生する。これがサージタンクc～エアホース～エアクリーナ～吸気ダクトを通して吸気音として音を発する（図9のイ）。とこ

ろが、次の時点（瞬間）で、他のシリンダdの吸気弁eが開くと（図9のロ）、該シリンダdがヘルムホルツの共鳴機構の働きをなし、吸気音の減衰を引き起こすのである。単なるスピーカ加振法による吸気音測定によると、こうしたエンジン実働における吸気音の減衰などの現象が起らないため、ズレを生じさせ吸気音精度を低くしてしまっている。このズレは図5の斜線部分で表される。そこで、本発明では、エンジン実働における吸気音の減衰などの影響分を前記補正値として算出して、吸気音精度を高めるのである。

【0012】上述のごとく補正値を算出して、しかる後、ようやく前記スピーカ加振法によって吸気音データを得ようと望む吸気系部品1（例えば吸気ダクト13等を変更したもの）の吸気音測定値を採る。図7はダクト変更した吸気系部品1のスピーカ加振法による吸気音測定値で、これを破線で示す。尚、図7中、実線は実機吸気音測定値である。そうして、このスピーカ加振法による吸気音測定値に補正値を加味（ここでは単純加算）して吸気音補正データとし、該吸気音補正データを車両吸気音の評価に使う。図8の破線グラフは、図7のスピーカ加振法の吸気音測定値に補正値を加算した吸気音補正データを表しており、実線グラフで表した実機吸気音測定値にほぼ重なる結果を示している。補正値の値（図6）は、前述のスピーカ加振法では起らず、吸気部品を実機に組み付けた場合にのみ発生するヘルムホルツ共鳴等（シリンダなどによる）の影響分を表している。そのため、スピーカ加振法によって得られた吸気音測定値に、該補正値を加えることで、単なるスピーカ加振法では通常再生できない現象を再生可能にし、吸気音補正データ（補正後のスピーカ加振法データ）は実機吸気音測定値とのピークのズレが殆ど生じなくなる。かくして、実際にエンジン2に吸気系部品1を組み付けずして実機吸気音に匹敵する精度の高い吸気音の評価ができることとなる。そして、一度この補正値を把握しておけば、次々と新たな吸気系部品の吸気音評価を簡便にして高精度で得ることができる。

【0013】このように構成した車両吸気音の評価方法は、スピーカ加振法に前述の補正値を加味することで、その評価精度を大幅に向上させることができる。従って、エンジン2を実働させて吸気音を測定する負担から開放され、車両吸気音の評価方法として有用で、しかも、評価費用の大幅な削減、評価工数の大幅な軽減を達成できる。吸気系部品1や様々なエンジン2の製品開発期間の短縮とコスト削減に貢献する。

【0014】尚、本発明においては、前記実施形態に示すものに限られず、目的、用途に応じて本発明の範囲で種々変更できる。本発明は、実施形態の吸気系部品1だけでなく、種々のエンジン2、吸気系部品1等に対応可能である。

【0015】

【発明の効果】以上のごとく、本発明の車両吸気音の評価方法は、測定設備費用を少なくして評価精度を高めることができ優れた効果を発揮する。

【図面の簡単な説明】

【図1】吸気系部品の実機吸気音を測定する装置の説明図である。

【図2】イコライザーのゲイン調整の様子を示す説明図である。

【図3】イコライザーのゲイン調整後のグラフである。

【図4】エンジンのスロットル近傍音を用いて、スピーカ加振法により吸気音測定している説明図である。

【図5】図4のスピーカ加振法による吸気音と実機吸気音との測定対比グラフである。

【図6】補正値のグラフである。

【図7】別の吸気系部品を組み付けた場合のスピーカ加振法による吸気音と実機吸気音との測定対比グラフである。

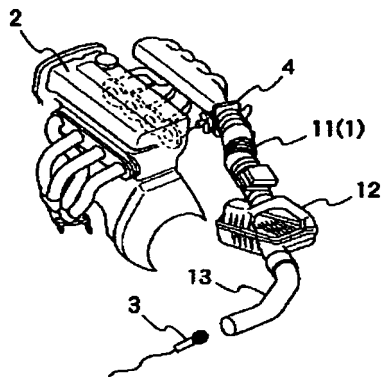
【図8】図7のスピーカ加振法の吸気音に補正値を加味した吸気音補正データと実機吸気音との測定対比グラフである。

【図9】吸気音の減衰機構の説明図である。

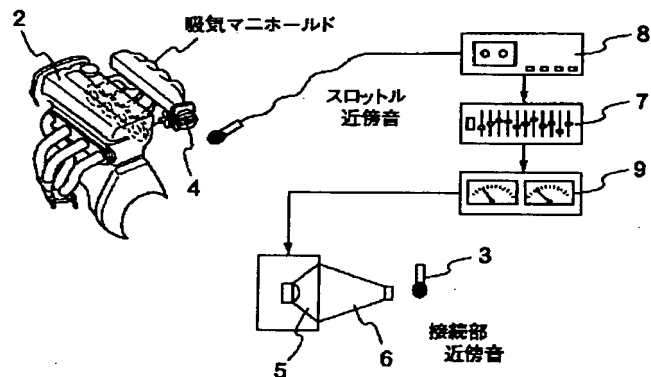
【符号の説明】

- | | |
|---|-------|
| 1 | 吸気系部品 |
| 2 | エンジン |
| 4 | スロットル |
| 5 | スピーカ |

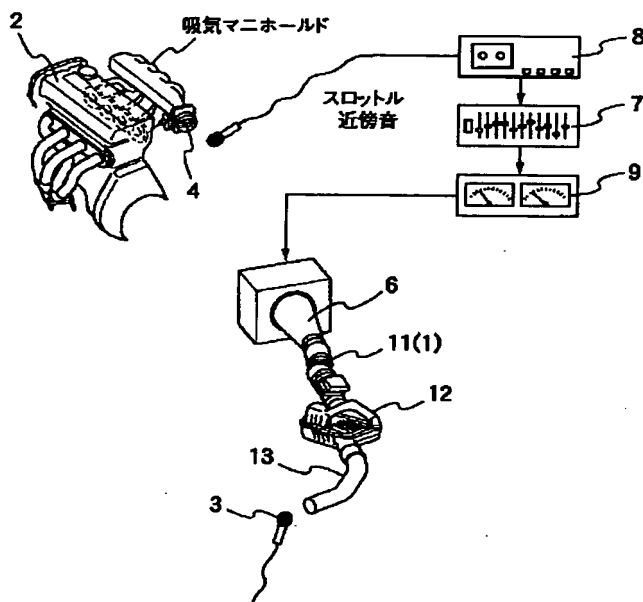
【図1】



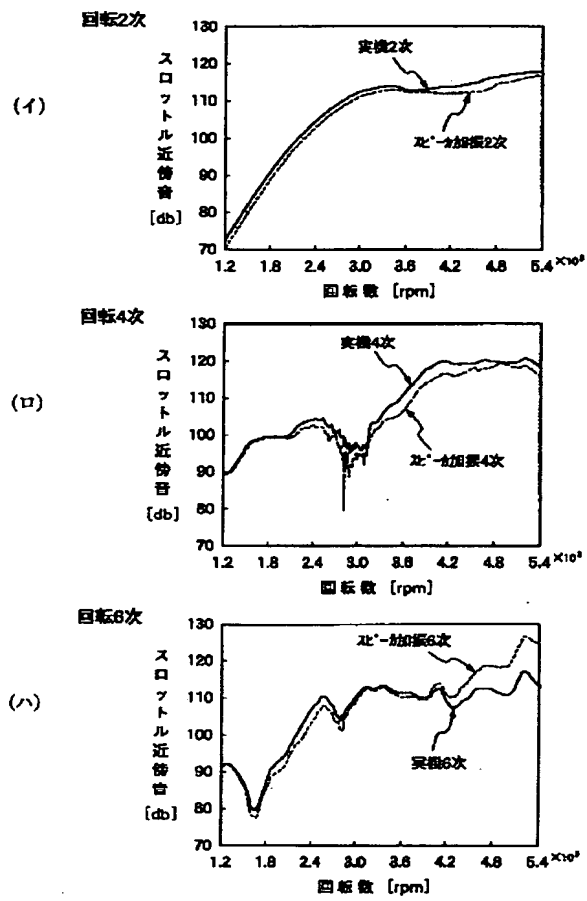
【図2】



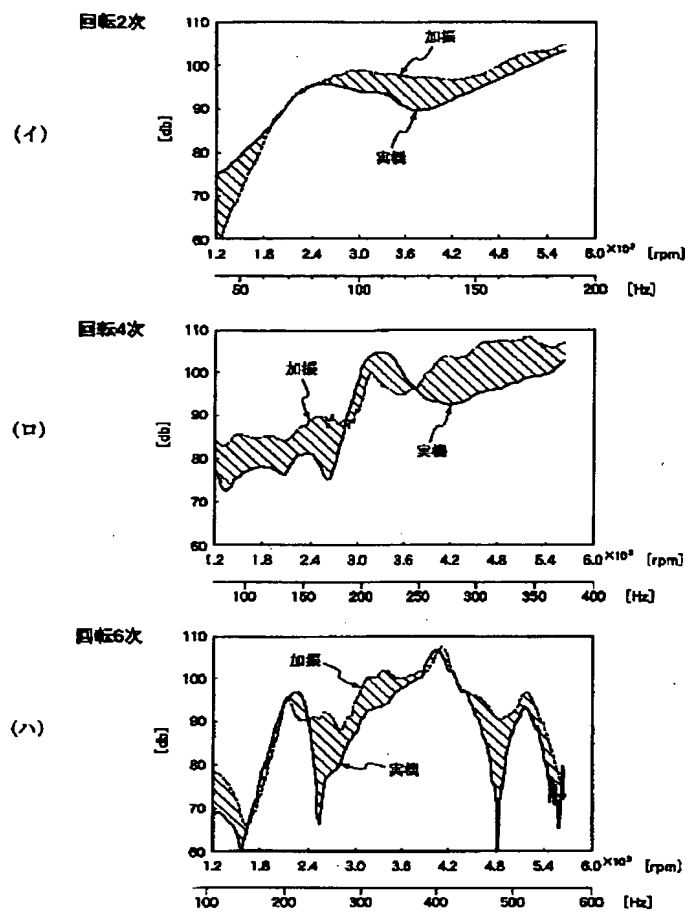
【図4】



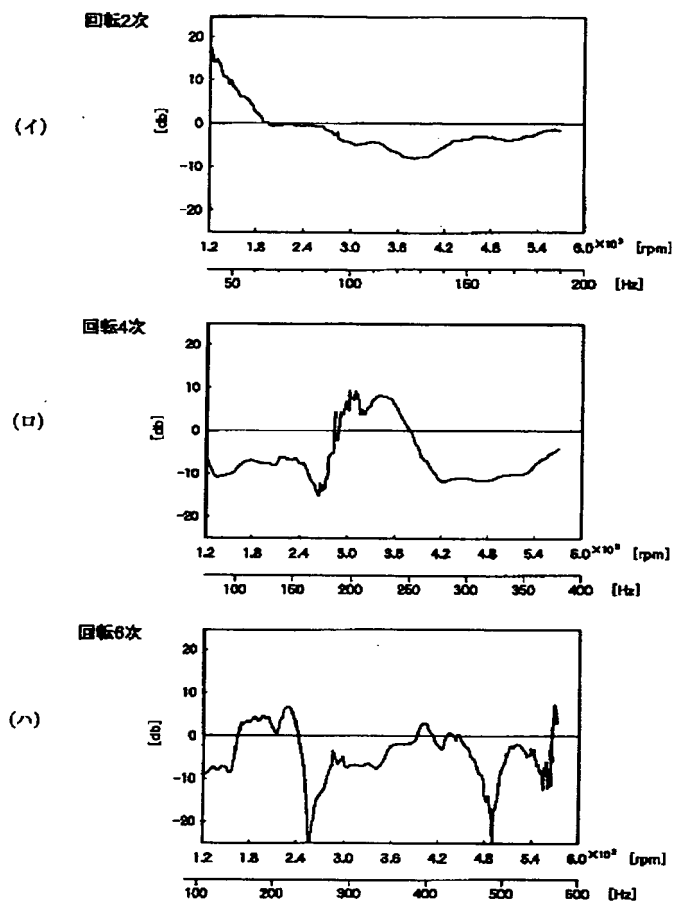
【図3】



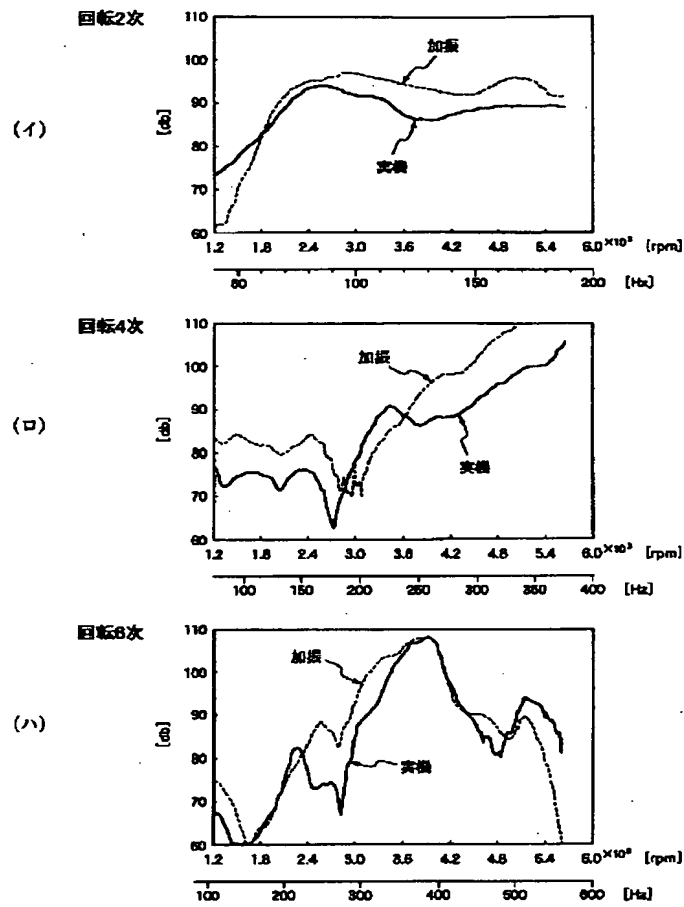
【図5】



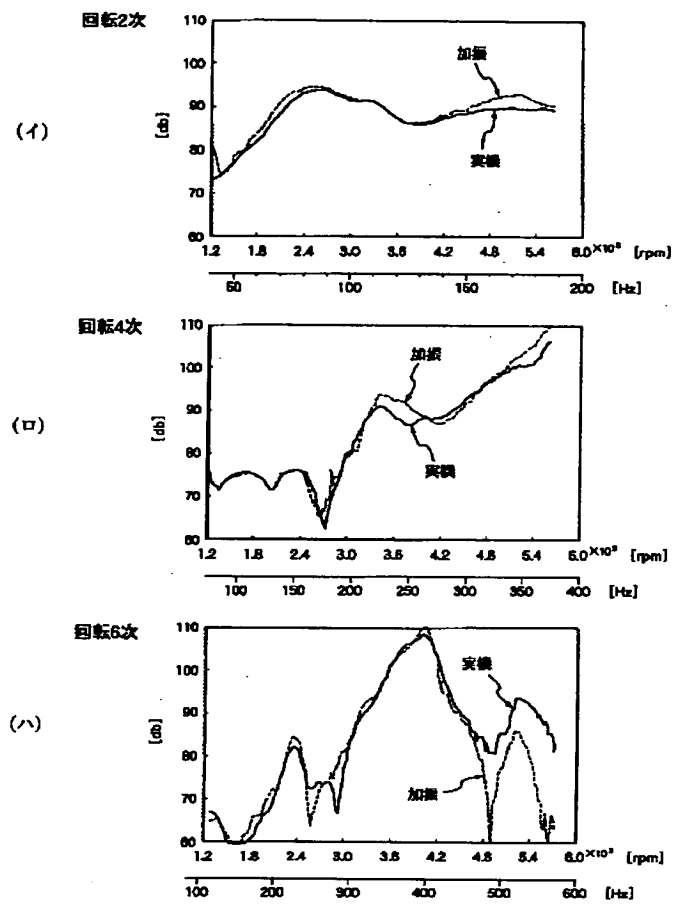
【図6】



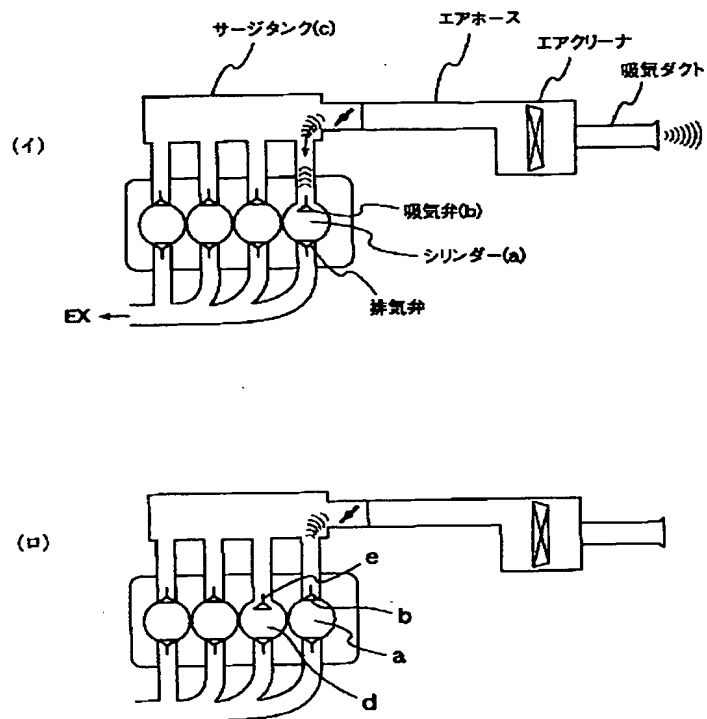
【図7】



【図8】



【図9】



フロントページの続き

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CLAIMS

[Claim(s)]

[Claim 1] It adjusts so that abbreviation coincidence may be carried out [sound / for inhalation-of-air system component mounting / at the loudspeaker outlet when inputting the engine sound near the throttle, and this sound near the throttle into a loudspeaker, and carrying out excitation of the loudspeaker / near the connection]. Subsequently From the measurement data of the system inhalation-of-air sound in engine working attached to an engine, inhalation-of-air system components Correction value is computed by attaching said inhalation-of-air system component in said connection, and deducting the measurement data of the inhalation-of-air sound which was made to carry out excitation of the loudspeaker into which said sound near the throttle was inputted, and measured it. Then, the evaluation approach of the car inhalation-of-air sound characterized by evaluating by seasoning with this correction value the inhalation-of-air sound measured value of the inhalation-of-air system components which were made to carry out excitation of said loudspeaker, and measured it.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the evaluation approach of a car inhalation-of-air sound used for evaluating the inhalation-of-air sound at the time of engine rotation of a passenger car etc.

[0002]

[Description of the Prior Art] In recent years, the noise-reduction demand of an automobile is increasing also compared with before, and a reduction demand is coming out also about the inhalation-of-air sound at the time of engine rotation as one of them. And it has come to be observed also about the evaluation approach of an inhalation-of-air sound with development of the inhalation-of-air system components of the low noise. Here, an inhalation-of-air sound points out the radiation sound which the sound generated when air generally enters into a cylinder transmits inhalation-of-air system components, and generates from the tip of an air intake duct. The firing method (system inhalation-of-air sound measuring method) and the motoring method are learned as an approach of evaluating current and an inhalation-of-air sound. The firing method is the approach of actually attaching inhalation-of-air system components to an engine, making an engine work, and measuring a system inhalation-of-air sound. Measurement of a system inhalation-of-air sound has measured 10cm of inlet right when equipping an engine with an air-intake-duct assembly like drawing 1, and the sound of 45-degree location. Although the motoring method also actually attaches and measures inhalation-of-air system components in an engine, the approach of making rotate an engine by the motor and measuring the inhalation-of-air sound is taken.

[0003]

[Problem(s) to be Solved by the Invention] By the way, the describing [above] firing method became what has a very large-scale measurement facility, although evaluation precision was good, and it had the difficulty which also attaches highly the costs which measurement takes. It is because it needs to be furnished for making an engine work. On the other hand, the motoring method needs engine reconstruction, and on a large scale, the measurement facility of what requires a man day does not become, but can hold down facility costs. However, it was the thing of only turning a motor and the evaluation precision was not so good.

[0004] This invention solves the above-mentioned trouble, and it aims at offering the evaluation approach of the car inhalation-of-air sound which can raise evaluation precision sharply, holding down the costs concerning a measurement facility low.

[0005]

[Means for Solving the Problem] That the above-mentioned purpose should be attained the summary of invention according to claim 1 It adjusts so that abbreviation coincidence may be carried out [sound / for inhalation-of-air system component mounting / at the loudspeaker outlet when inputting the engine sound near the throttle, and this sound near the throttle into a loudspeaker, and carrying out excitation of the loudspeaker / near the connection]. Subsequently From the measurement data of the system inhalation-of-air sound in engine working attached to an engine, inhalation-of-air system components Correction value is computed by attaching said inhalation-of-air system component in said connection, and deducting the measurement data of the inhalation-of-air sound which was made to carry out excitation of the loudspeaker into which said sound near the throttle was inputted, and measured it. Then, it is in the evaluation approach of the car inhalation-of-air sound characterized by evaluating by seasoning with this correction value the inhalation-of-air sound measured value of the inhalation-of-air system components which were made to carry out excitation of said loudspeaker, and measured it.

[0006] If it evaluates by seasoning with correction value the inhalation-of-air sound of the inhalation-of-air system components which were made to carry out excitation of the loudspeaker and measured it like invention according to claim 1, since an influenced part of the helmholtz resonance which takes place only when inhalation-of-air components are attached to the system will also be considered, accurate evaluation is attained though a measurement facility is simplified.

[0007]

[Embodiment of the Invention] Hereafter, the operation gestalt of the evaluation approach of the car inhalation-of-air sound concerning this invention is explained in full detail. Drawing 1 - drawing 8 express one gestalten, such as equipment used for the evaluation approach of the car inhalation-of-air sound of this invention. The explanatory view of the equipment with which drawing 1 measures the system inhalation-of-air sound of a certain inhalation-of-air system components, the explanatory view in which drawing 2 shows the situation of the gain adjustment of an equalizer, Drawing 3 uses the graph after the gain adjustment of an equalizer, and drawing 4 uses the engine sound

near the throttle. The explanatory view which is carrying out inhalation-of-air sound measurement by the loudspeaker excitation method, the measurement contrast graph of the inhalation-of-air sound and a system inhalation-of-air sound according [drawing 5] to the loudspeaker excitation method of drawing 4 , The measurement contrast graph of the inhalation-of-air sound and system inhalation-of-air sound by the loudspeaker excitation method when drawing 6 attaches inhalation-of-air system components with another graph of correction value and drawing 7 , and drawing 8 are the measurement contrast graphs of the inhalation-of-air sound amendment data and the system inhalation-of-air sound which seasoned the inhalation-of-air sound of the loudspeaker excitation method of drawing 7 with correction value. In addition, that it is with the system in the graph of drawing 5 - drawing 8 means a system inhalation-of-air sound, and that it is with excitation means the inhalation-of-air sound by the loudspeaker excitation method.

[0008] The evaluation approach of the car inhalation-of-air sound of this invention is performed by the following procedures, for example. First, an air hose 11, an air cleaner 12, and a certain inhalation-of-air system components 1 equipped with the air-intake-duct 13 grade are actually attached to an engine 2 as the first actuation, and the system inhalation-of-air sound at the time of engine rotation is measured (drawing 1). The continuous-line graph of drawing 5 expresses the measurement result of the system inhalation-of-air sound at the time of this engine rotation. Measurement of an inhalation-of-air sound measures 10cm of inlet right of the inhalation-of-air system components 1, and the sound of 45-degree location like illustration. A sign 3 shows an inhalation-of-air sound measuring instrument.

[0009] Next, the sound near the throttle of the system engine 2 is measured like drawing 2 (the second actuation). And it adjusts so that abbreviation coincidence may be carried out [sound / for inhalation-of-air system component mounting / at the loudspeaker outlet when inputting the sound near the throttle of this system engine 2, and the near sound of this throttle 4 into a loudspeaker 5, and carrying out excitation of that loudspeaker 5 as the third actuation, / near the connection]. The sound near the throttle and the sound near the connection are made specifically in agreement by adjusting the gain of an equalizer 7. A sign 8 shows a magnetic tape recorder among drawing 2 , and a sign 9 shows amplifier. In addition, the converging section extracted from the loudspeaker 5 for excitation in the shape of a cone is formed in a connection 6 that the inhalation-of-air system components 1 which it is going to measure should be made easy to attach. Drawing 3 shows the graph which made the sound near the connection (loudspeaker excitation) in agreement with the sound near the throttle (system) in this way. In addition, the 4-cylinder engine is used with this operation gestalt. Therefore, torque fluctuation occurs in 2, 4, 6, and — time (count changed to engine 1 rotation), and the noise is emitted by oscillating legal force. Although it is called the secondary component [4th / 6th] of rotation of this, each graph of drawing 3 expresses this secondary rotation and the 4th near sound [6th]. Each graph of drawing 5 - drawing 8 also corresponds to this secondary rotation and the 4th order [6th].

[0010] Then, an inhalation-of-air sound is measured by the loudspeaker excitation method using said inhalation-of-air system component 1 and the sound near the throttle (the fourth actuation). In detail, after attaching said inhalation-of-air system component 1 in a connection 6, the magnetic tape recorder 8 which recorded the sound near the throttle of the system engine 2 is reproduced, and it amplifies with amplifier 9, applying the gain adjustment which the equalizer 7 mentioned above in this, excitation of the loudspeaker 5 is carried out, and the inhalation-of-air sound of the inlet of the inhalation-of-air system components 1 is measured (drawing 4). The broken-line graph of drawing 5 expresses the result of having measured the inhalation-of-air sound by this loudspeaker excitation method.

[0011] Then, correction value is computed by attaching the inhalation-of-air system components 1 in the above-mentioned connection 6, and deducting the measurement data of the inhalation-of-air sound which was made to carry out excitation of the loudspeaker 5 into which the sound near the throttle was inputted, and measured it from the measurement data of the system inhalation-of-air sound in engine working obtained by said first actuation (the fifth actuation). If drawing 5 explains correction value, it will deduct the value of the inhalation-of-air sound by the loudspeaker excitation method from the value of a system inhalation-of-air sound expressed with the continuous line and only this correction value will be graph-ized, it will become like drawing 6 . It is because the inhalation-of-air sound measured value in a loudspeaker excitation method will induce gap between the system inhalation-of-air sound measured value of engine working if computing this correction value limits to the approach of measuring an inhalation-of-air sound by the loudspeaker excitation method using the inhalation-of-air system components 1 and the sound near the throttle. That is, if an air hose 11, an air cleaner 12, and the inhalation-of-air system components 1 of air-intake-duct 13 grade are attached and measured, since the situation where only the case of engine working forms the cylinder of an engine 2 in the resonance device of helmholtz exactly, and attenuates an inhalation-of-air sound will occur, a difference is shown as both measured value. Using drawing 9 , when attenuation of this inhalation-of-air sound is explained a little in more detail, it is as follows. In a certain cylinder a, an inlet valve b opens, and when a piston descends and air is inhaled, a sound occurs. This emits a sound as an inhalation-of-air sound through a surge tank c an air hose an air cleaner - an air intake duct (I of drawing 9). However, it is at the next time (moment), and if the inlet valve e of other cylinders d opens (RO of drawing 9), this cylinder d will cause attenuation of nothing and an inhalation-of-air sound for work of the resonance device of helmholtz. According to the inhalation-of-air sound measurement by the mere loudspeaker excitation method, since phenomena, such as attenuation of the inhalation-of-air sound in such engine working, do not happen, gap was produced and inhalation-of-air sound precision has been made low. This gap is expressed in the shadow area of drawing 5 . So, in this invention, an influenced part of attenuation of the inhalation-of-air sound in engine working etc. is computed as said

correction value, and inhalation-of-air sound precision is raised.

[0012] Like ****, correction value is computed and the inhalation-of-air sound measured value of the inhalation-of-air system components 1 (for example, thing which changed the air-intake-duct 13 grade) wished that inhalation-of-air sound data will be obtained by said loudspeaker excitation method at last after an appropriate time is taken.

Drawing 7 is the inhalation-of-air sound measured value by the loudspeaker excitation method of the inhalation-of-air system components 1 which made a duct change, and shows this with a broken line. In addition, a continuous line is system inhalation-of-air sound measured value among drawing 7. Then, inhalation-of-air sound measured value by this loudspeaker excitation method is seasoned with correction value (here simple addition), it considers as inhalation-of-air sound amendment data, and these inhalation-of-air sound amendment data are used for evaluation of a car inhalation-of-air sound. The broken-line graph of drawing 8 expresses the inhalation-of-air sound amendment data which added correction value to the inhalation-of-air sound measured value of the loudspeaker excitation method of drawing 7, and shows the result which laps with the system inhalation-of-air sound measured value expressed with the continuous-line graph mostly. The value (drawing 6 R> 6) of correction value does not happen, but expresses with the above-mentioned loudspeaker excitation method a part of the helmholtz resonance generated only when inhalation-of-air components are attached to the system influenced (based on a cylinder etc.). A usually unreproducible phenomenon is made refreshable and gap of a peak with system inhalation-of-air sound measured value stops therefore, almost producing inhalation-of-air sound amendment data (loudspeaker excitation method data after amendment) by the mere loudspeaker excitation method by applying this correction value to the inhalation-of-air sound measured value obtained by the loudspeaker excitation method. Evaluation of an inhalation-of-air sound with a high precision which actually attaches and makes an engine 2 the inhalation-of-air system components 1, and is equal to a system inhalation-of-air sound in this way can be performed. And once it grasps this correction value, one after another, it is made simple, and it is highly precise and inhalation-of-air sound evaluation of new inhalation-of-air system components can be obtained.

[0013] Thus, the evaluation approach of the constituted car inhalation-of-air sound can raise the evaluation precision sharply by seasoning a loudspeaker excitation method with the above-mentioned correction value. Therefore, it is wide opened from the burden which an engine 2 is made to work and measures an inhalation-of-air sound, and it is useful as the evaluation approach of a car inhalation-of-air sound, and, moreover, drastic reduction of evaluation costs and large mitigation of an evaluation man day can be attained. It contributes to compaction and the cost reduction of the product-development period of the inhalation-of-air system components 1 or various engines 2.

[0014] In addition, in this invention, it is not restricted to what is shown in said operation gestalt, but can change variously in the range of this invention according to the purpose and an application. This invention can respond not only to the inhalation-of-air system components 1 of an operation gestalt but to the various engines 2 and inhalation-of-air system components 1 grade.

[0015]

[Effect of the Invention] Like the above, the evaluation approach of the car inhalation-of-air sound of this invention demonstrates the effectiveness which could lessen measurement facility costs, could raise evaluation precision, and was excellent.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the explanatory view of the equipment which measures the system inhalation-of-air sound of inhalation-of-air system components.

[Drawing 2] It is the explanatory view showing the situation of the gain adjustment of an equalizer.

[Drawing 3] It is a graph after the gain adjustment of an equalizer.

[Drawing 4] It is the explanatory view which is carrying out inhalation-of-air sound measurement by the loudspeaker excitation method using the engine sound near the throttle.

[Drawing 5] It is the measurement contrast graph of the inhalation-of-air sound and system inhalation-of-air sound by the loudspeaker excitation method of drawing 4 .

[Drawing 6] It is the graph of correction value.

[Drawing 7] It is the measurement contrast graph of the inhalation-of-air sound and system inhalation-of-air sound by the loudspeaker excitation method at the time of attaching another inhalation-of-air system components.

[Drawing 8] It is the measurement contrast graph of the inhalation-of-air sound amendment data and the system inhalation-of-air sound which seasoned the inhalation-of-air sound of the loudspeaker excitation method of drawing 7 with correction value.

[Drawing 9] It is the explanatory view of the attenuation device of an inhalation-of-air sound.

[Description of Notations]

1 Inhalation-of-Air System Components

2 Engine

4 Throttle

5 Loudspeaker

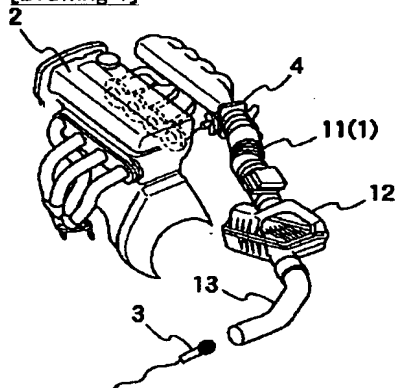
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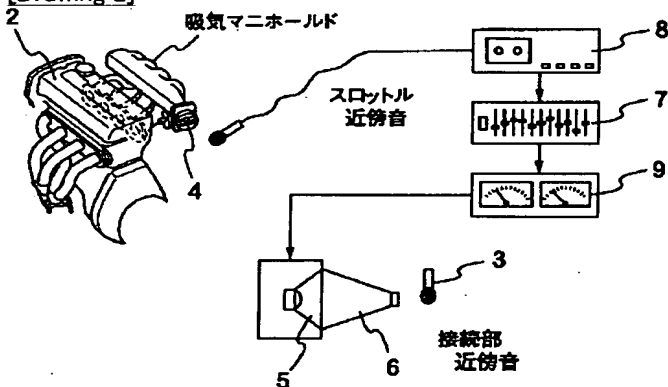
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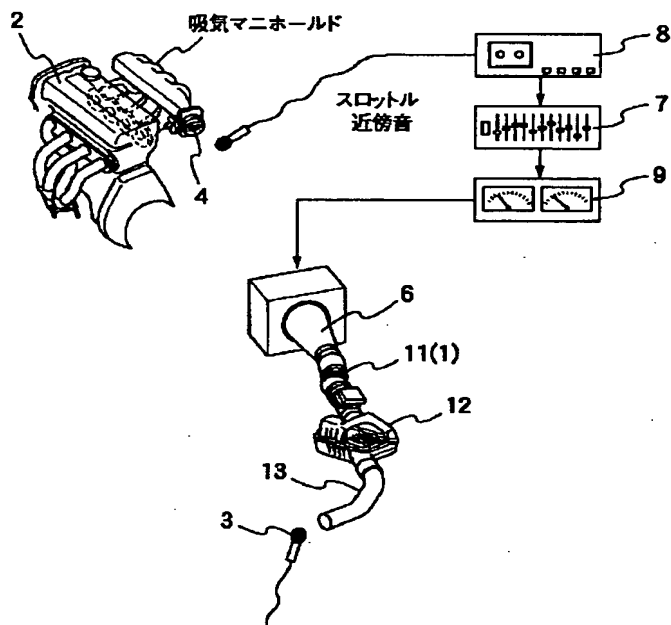
[Drawing 1]



[Drawing 2]



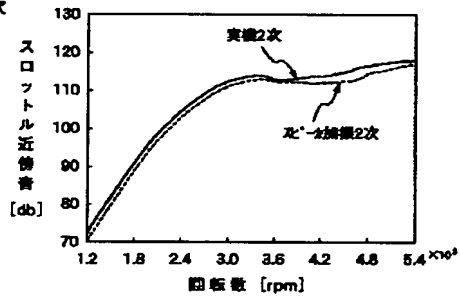
[Drawing 4]



[Drawing 3]

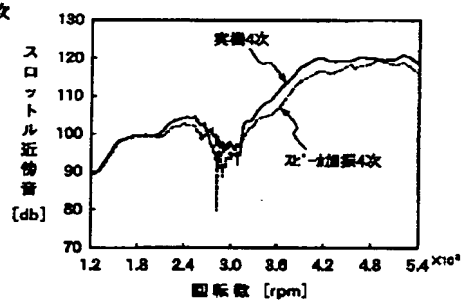
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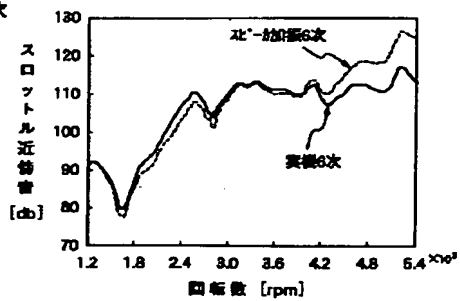
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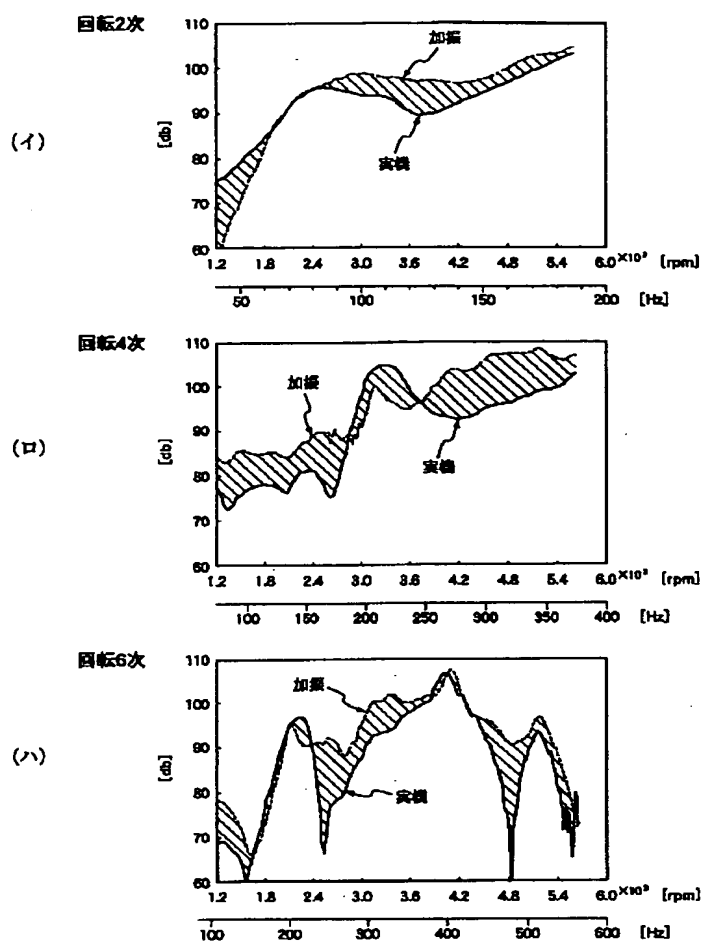


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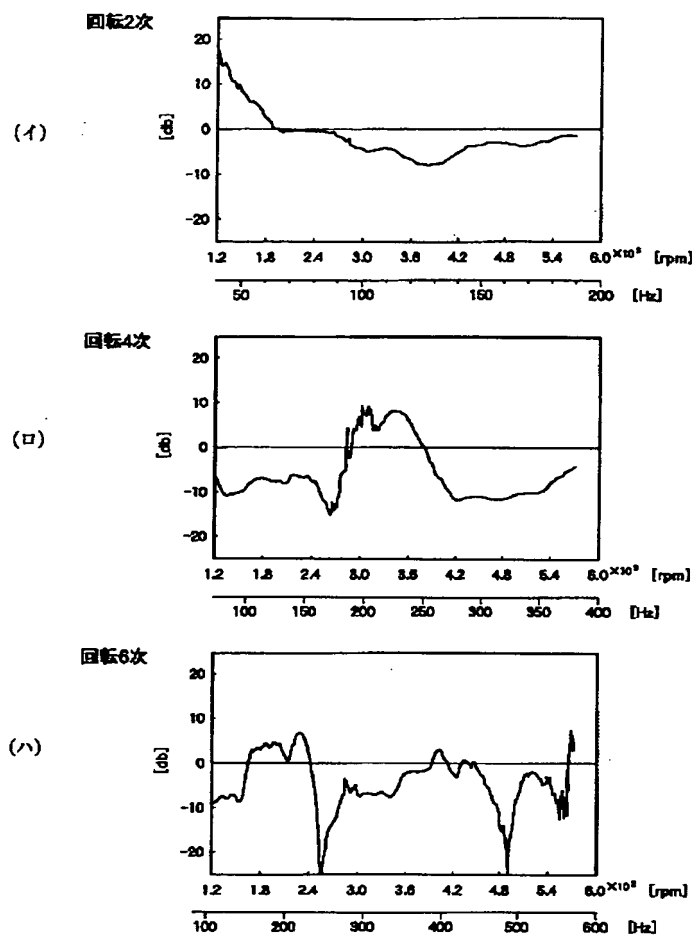
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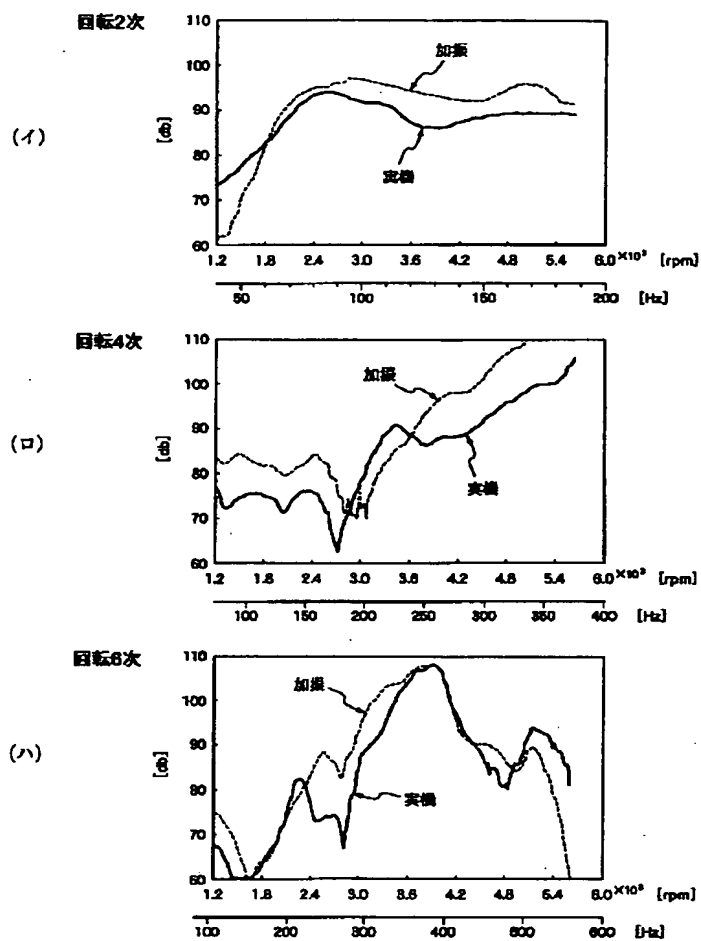
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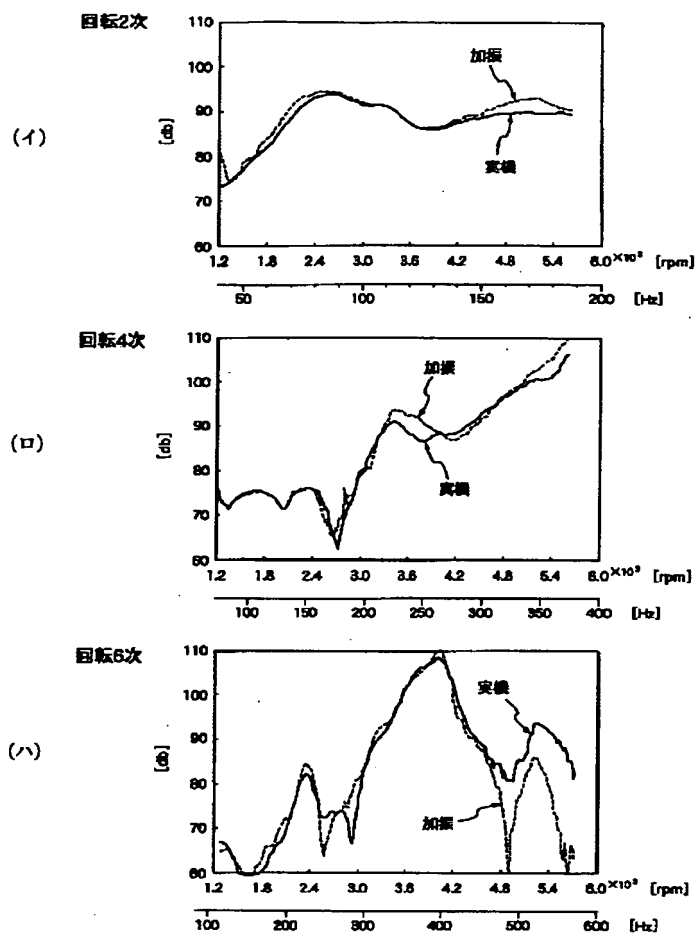
[Drawing 6]



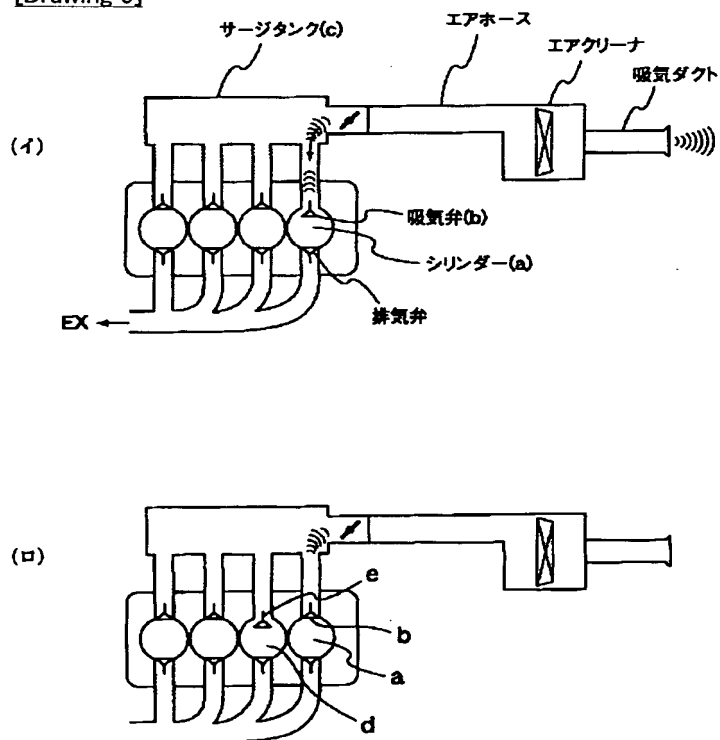
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]